

California Agricultural Teachers' Essential Guide to Safety



1/2007

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Shop

Safety Instructions to Be Observed in All Shop Areas

1. Walk—do not run—in shop areas.
27. Horseplay has no place in the shop.
28. Secure permission from supervisor/instructor for special set-ups.
29. Be considerate of the safety of others.
30. Adhere to safety rules pertinent to a specific shop.
31. Do not use tools or equipment until instruction relative to safe handling has been given.
32. Persons not operating power tools or instructed to observe the operation thereof should keep clear of operators.
33. Do not stop or start a machine for another person except in an emergency.
34. Only one person will operate machines at a time.
35. Report unsafe conditions to supervisor.
36. Form correct habits under normal conditions so you will automatically do the correct thing if required to work under pressure.
37. Read and follow the precautions and information from safety posters.
38. Do not use machines for trivial operations, or when hand tools would best accomplish the task.
39. Students working in shop areas must confine their long hair and avoid wearing apparel subject to catching on or in machinery. Rings, bracelets, watches, etc. should not be worn.
40. Never throw objects in shop. Distraction or injury can result.
41. Do not tamper with adjustments or play with machinery at any time. Serious accidents can be caused by such action.
42. Do not lean on machines; you may press a switch or throw a control, which, upon starting, could endanger the safety of the operator or the machine.
43. Gloves should be worn when raw materials such as rough boards, metal subject to burrs or sharp edges, glass, or other materials in the rough are handled.
44. Eye protection is mandatory.
45. Compressed air must never be used for other than specific purposes.
46. Stop all power machinery to oil, adjust, or clean.
47. Allow revolving machinery to stop on its own. Resist the desire to grab chucks, spindles, or other rotating parts with the hand.
48. Set up shields to stop flying chips, sparks, or particles.
49. Replace grinding wheels showing cracks, those out of balance, or those worn too small to allow proper clearance (not more than 1/8") between tool rest and stone.
50. Keep cutting tools sharp.
51. Oily rags and other highly combustible materials must be kept in a closed metal container.
52. Ground all portable and stationary power tools.
53. Keep hoses and electrical cords trip-free.
54. Never mount a grinding wheel unless the speed of the motor and the speed of the wheel are known and the two are appropriate.
55. Store flammable liquids in approved safety containers.

56. Avoid using electric drills or other electrical apparatus while standing on wet floors.
57. Make certain hands are free of oil or grease and that hammer, screwdriver, chisel, etc. handles are free of oil and grease.
58. When starting a machine, allow it to reach its proper operating RPM before using.
59. When finished with a tool, clean and replace it so it cannot fall.
60. Cords are to be disconnected when portable tools are not in use.
61. Vise handles should hang free when not in use.
62. Know and follow the specific requirements of the kind and type of machine you are going to operate.
63. Use the correct tool for the job.
64. Check for frayed electrical cords and for chafed or worn air hoses.
65. Floors are to be kept free of accumulation of materials or scrap and should be of non-skid surface.
66. The area should be swept daily and cleaned thoroughly periodically.
67. Workstations are to be closed at the end of each class period.
68. Shop area is to be neat and orderly in appearance at all times. Cluttered or dirty shops are good sites for accidents. Neat and orderly shops help eliminate unsafe working conditions.
69. Aisles should be kept clear by putting stock away promptly after using.
70. Shops should be properly ventilated. Serious disorders can be caused by uncontrolled vapors, mists, gases, and fumes.
71. Light is essential for sight. Sight is essential for safety. Keep windows, light bulbs, reflectors, and walls bright but without glare. Replace burned-out bulbs at once.
72. Fire extinguishers must be available and instructions given for proper use.
73. Fire regulations pertinent to the shop should be studied and familiar so you can assist in closing windows, make proper exit, etc.
74. Wear protective clothing and equipment. Avoid wearing anything which may be pulled into machinery.
75. Sleeves are to be kept rolled up, shirttails in, and long ties and jewelry removed. Aprons should be snugly secured.
76. A person feeling ill should not operate a machine—report to supervisor.
77. Use proper lifting techniques when moving heavy objects.
78. Report any injury to supervisor immediately.
79. Have cuts, burns, or bruises—however minor—treated immediately by the school nurse or other qualified person.
80. Neither supervisor nor employees are to treat or remove particles from the eye.
81. Eyestrain is a frequent cause of accidents. If the job subjects you to eyestrain, provide additional light.
82. Avoid placing hands to mouth or eyes while working.

General Safety Instructions for Operating Power Tools

1. Know your power tool. Read operator's manual carefully. Learn its applications and limitations as well as the specific potential hazards peculiar to this tool.
2. Ground all tools—unless double-insulated. If tool is equipped with three-prong plug, it should be plugged into a three-hole electrical receptacle. If adapter is used to accommodate two-prong receptacle, the adapter wire must be attached to a known ground. (Usually the screw secures the receptacle cover plate.) Never remove third prong.
3. Keep guards in place and in working order.
4. Keep work area clean. Cluttered areas and benches invite accidents.
5. Avoid a dangerous environment. Do not use power tool in damp or wet locations. Keep the work area well lighted.
6. Keep children away. All visitors should be kept safe distance from work area.
7. Store idle tools. When not in use, tools should be stored in a dry, high, or locked place.
8. Don't force a tool. It will do the job better and safer at the rate for which it was designed.
9. Use the right tool. Do not force a small tool or attachment to do the job of a heavy-duty tool.
10. Wear proper apparel. Wear no loose clothing or jewelry to get caught in moving parts. Rubber gloves and footwear are recommended when working outdoors.
11. Use safety glasses with most tools. Also face or dust mask should be used if cutting operation is dusty.
12. Do not abuse cords. Never carry tool by its cord or yank the cord to disconnect the tool from receptacle. Keep cords from heat, oil, and sharp edges.
13. Secure work. Use clamps or a vise to hold work. Using a vise or clamp is safer than using your hand, and both hands are free to operate the tool.
14. Do not over-reach. Keep proper footing and balance at all times.
15. Maintain tools with care. Keep tools sharp at all times, and keep them clean for the best and safest performance. Follow instructions for lubricating and changing accessories.
16. Disconnect tools when they are not in use, before servicing, and when changing attachments, blades, bits, cutters, etc.
17. Remove adjusting keys and wrenches. Form the habit of checking to see that keys and adjusting wrenches are removed from the tool before turning it on.
18. Avoid accidental starting. Do not carry a plugged-in tool with your finger on switch.

General Power Tools

Read and understand operator's manual.

1. Learn the power tool's applications and limitations as well as the specific potential hazards peculiar to the tool you are using.
2. Ground all tools unless double insulated. If the tool is equipped with a three-prong plug, it should be plugged into a three hole electrical receptacle. If an adapter is used to accommodate a two-hole receptacle, the grounding ear must be attached to a known ground. Never remove the third prong.
3. Keep guards in place and in working order.
4. Keep work areas clean. Cluttered areas and benches invite accidents.
5. Avoid dangerous environments. Don't expose power tools to rain or use in damp or wet locations. Do not use tool in presence of flammable liquids or gases. Keep the work area well lit.
6. Keep children away. All visitors should be kept a safe distance from the work area. Do not let visitor's contact tool or extension cords.
7. Store idle tools.
8. Don't force tool. It will do the job better and safer at the rate for which it was designed.
9. Use right tool. Don't force a small tool or attachment to do the job of a heavy-duty tool. Don't use tool for a purpose it was not designed for, such as using a circular saw for cutting tree limbs or logs.
10. Wear proper apparel. No loose clothing or jewelry to get caught in moving parts. Rubber gloves and insulated non-skid footwear is recommended when working outdoors. Wear protective covering to contain long hair.
11. Use safety glasses at all times. Also, use a face or dust mask if cutting operation is dusty.
12. Don't abuse cord. Never carry the tool by its cord or yank it to disconnect from the receptacle. Keep cord from heat, oil and sharp edges.
13. Secure work. Use clamps or a vise to hold work. It's safer than using your hand and it frees both hands to operate tool.
14. Don't overreach. Keep proper footing and balance at all times.
15. Disconnect tools when not in use; before servicing; when changing accessories such as blades, bits, cutters, etc.
16. Guard against electric shock. Prevent body contact with grounded surfaces such as pipes, radiators, ranges, and refrigerator enclosures.
17. Remove adjusting keys and wrenches. Form a habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
18. Maintain tools with care. Keep tools sharp and clean at all times for best and safest performance. Follow instructions for lubricating and changing accessories. Keep handles dry clean and free of oil or gas. Inspect switches, tool cords and extension cords periodically and have them repaired or replaced by an authorized service facility if damaged. Check moving parts for alignment and binding as well as for breakage and improper mounting.
19. Avoid accidental starting. Don't carry a plugged-in tool with your finger on the switch. Be sure the switch is turned off before plugging in a tool. Do not use a tool if the switch does not turn it on or off.
20. Wear ear protectors when using for extended periods.

21. Accessories -the use of any accessories other than what is listed or recommended for this particular tool may be hazardous.
22. Keep hands away from all moving parts, blades, bits, etc.
23. Use insulated surfaces. A double-insulated or grounded tool may be made live if the blade or bit comes in contact with live wiring in a wall, floor, ceiling, etc. Always check the work area for live wires and hold the tool by the insulated surfaces when "blind " sawing.
24. Stay alert. Watch what you are doing and use common sense. Do not operate tool when you are tired.
25. Grounding
 - a. Double Insulated—tools with two prong plugs. Tools marked with the words "Double Insulated" are equipped with a two-prong plug.
 - b. Grounded—tools with three prong plugs. These tools must be grounded while in use to protect the user from electric shock. The tool is equipped with an approved, three-conductor cord and three-prong grounding type plug to fit the proper grounding-type receptacle. The green conductor in the cord is the grounding wire. Never connect a green wire to a live terminal.

Pipe and Bolt Threading Machine

Read and understand operator's manual.

Warning: Clothing/gloves can be caught in moving parts; fingers, hands, arms or other body parts can be crushed or broken.

- a. Use footswitch.
- b. Do not wear gloves.
- c. Keep sleeves and jacket buttoned.
- d. Do not reach across machine because clothing can be drawn into moving parts.
- e. Operate machine from switch side only.
- f. Do not disconnect or block footswitch.
- g. Keep footswitch in working order.
- h. Make sure switch is in the "off" position before plugging in power cord.
- i. Make sure you can quickly remove your foot from the footswitch.

Personal Safety:

- a. Wear snug fitting clothes, safety shoes, hardhat and safety glasses. Cover up or tie up long hair. Do not wear loose clothing, gloves, unbuttoned jackets, loose sleeve cuffs, neckties, rings, watches or other jewelry.
- b. Wear hearing protectors, earplugs or muffs if you use the machine daily or in a very noisy area.
- c. Operate machine from the side with the REV/OFF/FOR switch.
- d. Keep good footing and balance. Do not overreach.
- e. Do not operate machine when you are tired.

Electrical Safety:

- a. Ground machine. Use approved three-conductor cord and three-prong grounding type plug in a grounded receptacle. The green (or green and yellow) conductor in the cord is the grounding wire. Do not connect the green (or green and yellow) wire to a live terminal. If your unit is for use on less than 150 volts, it has a 120V plug. If it is for use on 150 to 250 volts, it has a 230V plug.
- b. Connect machine to an AC power supply that matches the nameplate specifications. Do not use D.C. power.
- c. Use only three-wire extension cords, which have three-prong grounding plugs and three-pole receptacles, which accept the machines plug. Replace or repair damaged, frayed, broken or worn cords.
- d. When using an extension cord, be certain that the conductor size is large enough to prevent excessive voltage drop which will cause loss of power.
- e. When using an extension cord outdoors, use cords marked with the suffix "W-A II" following the cord type designation. For example, SJTW-A II indicates that the cord is acceptable for outdoor use.
- f. Do not use machine in damp or wet locations. Do not expose to rain.
- g. Unplug power cord when adjusting, servicing or changing accessories.

Work Area Safety:

- a. Keep children and visitors out of work area. If visitors must be in an area keep them far away from the machine and extension cord.
- b. Keep work areas clean, uncluttered and well lighted.
- c. Keep floors dry and free of slippery materials.

- d. Clear machine and bench of all objects such as wrenches or tools before turning machine on.

Machine Safety:

- e. The machine is made to thread and cut pipe or bolts. Other uses may increase risk of injury.
- f. Secure machine to bench or stand to keep it from tipping over.
- g. Tighten chuck hand wheel and engage rear-centering device on the work before turning on machine.
- h. Support long, heavy work from the floor with a pipe support to prevent tipping of machine.
- i. Use recommended accessories. Use of other accessories may increase the risk of injury.
- j. Check for broken or damaged parts before using machine. Repair or replace damaged guards or other machine parts by an authorized service center to insure proper operation of the machine.
- k. Do not use machine if switches are broken.
- l. Keep covers in place. Do not operate machine with covers removed.

Machine Maintenance:

- a. Use sharp cutting tools.
- b. Follow instructions for lubricating and changing accessories.
- c. Inspect machine cord. Replace damaged, frayed, broken or worn machine cord.
- d. Inspect extension cords. Repair or replace damaged, frayed, broken or worn cords.
- e. Keep handles dry and clean. Keep free from oil and grease.
- f. When not being used, store machine in a secured, locked area, out of reach of children and people unfamiliar with the threading machine.
- g. Lock footswitch when not in use to avoid accidental starting.

Floor Jacks (Hydraulic)

1. Make sure that jack makes secure contact with the frame of equipment.
2. Be sure contact point is strong enough to not be damaged or unstable.
3. Always use jack stands to support equipment while performing repairs.
4. Put all equipment back in proper location.
5. Be sure to clean area of oil, grease and dirt.

Safety with Lead/Acid Batteries

1. Always wear safety glasses. Batteries contain hydrogen gas and can explode showering you with acid.
2. Batteries contain acid that will cause burns on the skin.
3. Always have baking soda on hand to neutralize spilled acid.

Battery Charging

1. Check instructions for proper settings and clamp positioning.
2. Caution: overcharging may damage battery. Also, be aware that heavy arcing at battery terminals can cause battery to explode.
3. After charging battery, turn charger off, remove cables one at a time, wipe off batteries.
4. Put all equipment back in proper location.

Proper Jump Starting with Cables

1. Must know the proper signs for positive (+) and negative (-) posts on batteries.
83. Connect to both terminals on jumper battery vehicle first.
84. Make sure that clamps are in the proper order. Positive (+) of one battery to positive (+) of the other battery. Clamp color, for example: red-to-red and black-to-black.
85. Connect one clamp to the non-ground terminal of the battery that is low. Then contact other clamp to ground, away from battery, and watch for excessive arcing.
86. Place clamp on ground terminal, keeping face away from battery.
87. Caution: heavy sparks can cause battery to explode. If heavy sparks occur, this is a sign of a problem. Recheck connections.
88. After starting, remove cables one at a time without arcing cables together.

Hand Tool Safety

1. Do not continue to work if your safety glasses become fogged. Stop work and clean the glasses until the lenses are clear and defogged.
2. Use tied off containers to keep tools from falling off of scaffolds and other elevated work platforms.
3. Carry all sharp tools in a sheath or holster.
4. Tag worn, damaged or defective tools "Out of Service" and do not use them.
5. Do not use a tool if its handle has splinters, burrs, cracks, splits or if the head of the tool is loose.
6. Do not use impact tools such as hammers, chisels, punches or steel stakes that have mushroomed heads.
7. When handing a tool to another person, direct sharp points and cutting edges away from yourself and the other person.
8. When using knives, shears or other cutting tools, cut in a direction away from your body.
9. Do not chop at heights above your head when you are working with a hand axe.
10. Do not carry sharp or pointed hand tools such as screwdrivers, scribes, aviation snips, scrapers, chisels or files in your pocket unless the tool or your pocket is sheathed.
11. Do not perform "make-shift" repairs to tools.
12. Do not use "cheaters" on load binders or "boomers".
13. Do not carry tools in your hand when you are climbing. Carry tools in tool belts or hoist the tools to the work area using a hand line.
14. Do not throw tools from one location to another, from one employee to another, from scaffolds or other elevated platforms.
15. Transport hand tools only in tool boxes or tool belts. Do not carry tools in your clothing.

Knives/Sharp instruments

1. When handling knife blades and other cutting tools, direct sharp points and edges away from you.
2. Cut in the direction away from your body when using knives.
3. Use the knife that has been sharpened; do not use knives that have dull blades.
4. Use knives for the operations for which they are named.
5. Do not use knives that have broken or loose handles.
6. Do not use knives as screwdrivers, pry bars, can openers or ice picks.
7. Do not leave knives in sinks full of water.
8. Do not pick up knives by their blades.
9. Carry knives with their tips pointed towards the floor.
10. Do not carry knives, scissors or other sharp tools in your pockets or an apron unless they are first placed in their sheath or holder.
11. Do not attempt to catch a falling knife.
12. Store knives in knife blocks or in sheaths after using them.
13. Follow this procedure for picking up any bags that have sharp objects protruding from them: Grab the top of the bag above the tie-off, using both hands, and hold the bag away from your body.
14. Do not submerge hot glass in cold water nor submerge cold glass in hot water.
15. When opening cartons use the safety box cutters. Do not cut with the blade extended beyond the guard.

16. Do not use honing steels that do not have disc guards.

Files/Rasps

1. Do not use a file as a pry bar, hammer, screwdriver or chisel.
2. When using a file or a rasp, grasp the handle in one hand and the toe of the file in the other.
3. Do not hammer on a file.

Chisels

1. Use the chisel that has been sharpened; do not use a chisel that has a dull cutting edge.
2. Do not use chisels that have "mushroomed" striking heads.
3. Hold a chisel by using a tool holder if possible.
4. Clamp small workpieces in the vise and chip towards the stationary jaw when you are working with a chisel.

Hammers

- Use a claw hammer for pulling nails.
- Do not strike nails or other objects with the "cheek" of the hammer.
- Do not strike a hardened steel surface, such as a cold chisel, with a claw hammer.
- Do not strike one hammer against another hammer.
- Do not use a hammer if your hands are oily, greasy or wet.
- Do not use a hammer as a wedge or a pry bar, or for pulling large spikes.
- Use only the sledge type hammer on a striking face wrench.

Saws

1. Keep control of saws by releasing downward pressure at the end of the stroke.
2. Do not use an adjustable blade saw such as a hacksaw, coping saw, keyhole saw or bow saw, if the blade is not taut.
3. Do not use a saw that has dull saw blades.
4. Oil saw blades after each use of the saw.
5. Keep your hands and fingers away from the saw blade while you are using the saw.
6. Do not carry a saw by the blade.
7. When using the hand saw, hold the workpiece firmly against the work table.
8. Use the circular saw guard when using the circular saw.

Screwdrivers

1. Always match the size and type of screwdriver blade to fit the head of the screw.
2. Do not hold the workpiece against your body while using a screwdriver.
3. Do not put your fingers near the blade of the screwdriver when tightening a screw.
4. Use a drill, nail, or an awl to make a starting hole for screws.
5. Do not force a screwdriver by using a hammer or pliers on it.
6. Do not use a screwdriver as a punch, chisel, pry bar or nail puller.
7. When you are performing electrical work, use the screwdriver that has the blue handle; this screwdriver is insulated.
8. Do not carry a screwdriver in your pocket.

9. Do not use a screwdriver if your hands are wet, oily or greasy.
10. Do not use a screwdriver to test the charge of a battery.
11. When using the spiral ratchet screwdriver, push down firmly and slowly.

Wrenches

1. Do not use wrenches that are bent, cracked or badly chipped or that have loose or broken handles.
2. Do not slip a pipe over a single head wrench handle for increased leverage.
3. Do not use a shim to make a wrench fit.
4. Use a split box wrench on flare nuts.
5. Do not use a wrench that has broken or battered points.
6. Use a hammer on striking face wrenches.
7. Discard any wrench that has spread, nicked or battered jaws or if the handle is bent.
8. Use box or socket wrenches on hexagon nuts and bolts as a first choice, and open end wrenches as a second choice.

Pliers

1. Do not use pliers as a wrench or a hammer.
2. Do not attempt to force pliers by using a hammer on them.
3. Do not slip a pipe over the handles of pliers to increase leverage.
4. When you are performing electrical work, use the pliers that have the blue rubber sleeves covering the handle; these pliers are insulated.
5. Do not use pliers that are cracked, broken or sprung.
6. When using the diagonal cutting pliers, shield the loose pieces of cut material from flying into the air by using a cloth or your gloved hand.

Vises & Clamps

1. When clamping a long workpiece in a vise, support the far end of the workpiece by using an adjustable pipe stand, saw horse or box.
2. Position the workpiece in the vise so that the entire face of the jaw supports the workpiece.
3. Do not use a vise that has worn or broken jaw inserts, or has cracks or fractures in the body of the vise.
4. Do not slip a pipe over the handle of a vise to gain extra leverage.
5. Do not use the C-clamp for hoisting materials.
6. Do not use the C-clamp as a permanent fastening device.

Snips

1. Wear your safety glasses or safety goggles when using snips to cut materials.
2. Wear your work gloves when cutting materials with snips.
3. Do not use straight cut snips to cut curves.
4. Keep the blade aligned by tightening the nut and bolt on the snips.
5. Do not use snips as a hammer, screwdriver or pry bar.
6. Use the locking clip on the snips after you have finished using them.

Tool Boxes/Chests/Cabinets

1. Use the handle when opening and closing a drawer or door of a tool box, chest, or cabinet.
2. Tape over or file off sharp edges on tool boxes, chests or cabinets.
3. Do not stand on tool boxes, chests or cabinets to gain extra height.
4. Lock the wheels on large tool boxes, chests or cabinets to prevent them from rolling.
5. Push large chests, cabinets and tool boxes; do not pull them.
6. Do not open more than one drawer of a tool box at a time.
7. Close and lock all drawers and doors before moving the tool chest to a new location.
8. Do not use a tool box or chest as a workbench.
9. Do not move a tool box, chest or cabinet if it has loose tools or parts on the top.

Bench Vise

1. Mount the vise firmly. Keep it tight on bench. A loose vise is dangerous and inefficient.
2. Lock swivel base securely. Tapered-gear lock bolt prevents slippage.
3. Do not hammer the handle. Too much pressure may damage the work.
4. Never use handle extension. Normal leverage will hold work securely in place.
5. Do not hammer the beam. Your vise will give almost unlimited use. But it will not stand continued abuse.
6. Oil the screw. Remove front jaw. Use oil or light grease. This should be done frequently to prevent screw wear.
7. Keep jaw faces clean. Use wire brush or file card to remove chips and dust.

Operating a Bench Grinder

1. Operate only after you have received instruction.
2. Wear proper clothing.
3. Wear face shield, safety glasses, or goggles and use glass safety guard on grinder.
4. See that the guard is in place.
5. Set tool rest 1/16 inch to 1/8 inch from the wheel.
6. Dress wheel when necessary.
7. Make sure that no one but you is inside the operator's area.
8. Adjust grinder for your job before turning power on
9. Stand to one side of wheel when turning power on. The wheel may be cracked, causing it to break up.
10. Turn on power after permission is given.
11. Keep hands away from the wheel while it is in motion.
12. Hold work with your hands. Ask permission to grind small pieces.
13. Use the face of the wheel only.
14. Press materials against wheel with correct amount of pressure.

Operating a Horizontal Band Saw

1. Operate only after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. All adjustments to the chip-removal brushes, blade tension, guides, vise, or drive system should be done with the power off.
6. Be sure blade guides are properly adjusted to both the blade and the work size or vise before starting cut.
7. Adjust feed rate so blade does not bounce or plunge into work when starting the cut.
8. Be sure work is tightly clamped in the vise and properly positioned for an efficient, safe cut.
9. Keep hands away from cutting area and brush away chips only when the machine is turned off.
10. If the material requires coolant, be sure that the system is working and that the correct coolant is used.

Operating a Portable Air Impact Wrench

1. Operate only after you have received instruction.
2. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Always use proper eye protection.
4. Be sure throttle is in the "off" position before connecting to air supply.
5. Always use impact-type sockets designed for use with power equipment.
6. Make sure work is secure or held with clamps or tightly in a vise.
7. Set torque control for correct tightness before starting the job.
8. Be sure both hands are free to properly operate an impact tool.
9. Maintain balance and firm footing at all times.
10. Always use the tool in short bursts of power.
11. Quick-change coupling should be at end of hose whip, not at the tool
12. Always disconnect the tool when not in actual use.

Operating a Portable Disc Sander/Grinder

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating properly.
4. Wear face shield, goggles, or safety glasses.
5. Before connecting to the power source, be sure the switch is in the "off" position.
6. Make sure back-up pad and disc are securely fastened to the tool. Unplug the sander when changing discs.
7. Do not allow the edge of the disc to touch the edge of the stock.
8. Stand clear of the spark line or spark area.
9. Sand or finish with a stroking motion; do not pause in one spot.
10. Set sander on back or on rubber stand when not in use and disconnect from power source.

Operating a Portable Electric Drill

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Always use proper eye protection.
4. "Unplug" the drill when changing bits.
5. Make sure switch is off and chuck key removed before connecting to power source.
6. Mark hole location with center punch (metal) or AWL (wood) before drilling.
7. Be sure work is tightly clamped or otherwise secure before drilling.
8. Drill with straight, even, steady pressure.

Operating an Oxygen-Acetylene Welder

1. Operate only after you have received instruction.
2. Wear proper clothing and protective equipment. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Be sure that you wear welding goggles. All assistants and observers must also wear welding goggles.
4. Close cylinder valve and replace protective cover before moving cylinder.
5. Fasten cylinders with a chain or other suitable device as a protection against falling or rolling.
6. Keep welding equipment free of oil and grease. Use only clean rags for wiping off welding equipment.
7. Inspect hose before using.
8. Make sure that hose is properly connected and that all connections are tight.
9. Report any leaking of cylinders or connections to supervisor immediately.
10. Make sure you have ample ventilation.
11. Keep all flammable material away from working area.
12. Release regulator pressure screw. Open cylinder valves gradually.
13. Open acetylene cylinder valve 1 turn or less. Keep wrench in place so that valve may be shut off quickly if necessary.
14. Keep acetylene pressure in the hose below 15 pounds per square inch
15. Use a flint lighter to ignite torch.
16. Close acetylene valve first if torch backfires.
17. Make certain lighted torch always points away from you and other students.
18. Keep sparks and flame away from cylinders.
19. Close cylinder valve when you have finished your welding job.
20. Quench section of metal that has been welded or mark with chalk or soapstone the word "hot" on the metal if it is necessary for you to leave your work.

Operating an Electric Welder

1. Operate only after you have received instruction.
2. Wear proper clothing to protect from arc burns. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear a hood with proper observation window, treated gauntlet gloves, and treated leather apron. All assistants and observers must also wear this equipment.
4. Rubber-soled shoes, without tacks, should be worn when electric welding.
5. Operator of electric welder is to allow no one to look at the arc without the dark shield (No. 10-12 lens).
6. Make sure electric welding is done only in a correctly constructed booth or room, or behind proper screens.
7. Make sure there is ample ventilation.
8. Keep all flammable material away from working area.
9. See that floor area is clear of all obstructions.
10. Report to supervisor at once if electrode holder, holder cable connection, cable, or cable terminals at the welding machine, ground clamps, lugs, or cable get hot.
11. While removing scale from the work, wear ordinary safety glasses or goggles.
12. Have a dry-chemical fire extinguisher handy when electric welding.
13. Hang up electrode holder and turn off welder when work is being changed or when work has been completed.

Operating a TIG and MIG Welder

1. Operate only after you have received instruction.
2. Wear proper clothing to protect from arc burns. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating correctly.
4. Always use proper eye protection.
5. Always buff using the lower half of the buffing wheel.
6. Additional protective welding clothing, including a helmet, long-sleeve jacket, and gloves, must be worn to prevent burns from ultraviolet and infrared rays emitted while arc welding.
7. The helmet used for TIG or MIG welding should be equipped with a minimum number-12 density shade.
8. Be certain that the welder equipped with a high-frequency stabilizing unit is installed, maintained, and used according to the recommendations of both the manufacturer and Federal Communication Commission.
9. Never touch the tungsten electrode or MIG wire while the welder is turned on. It is electrically "hot" and can cause a serious shock.
10. Never use the high frequency when performing shield metal arc (stick electrode) welding.

Metal Cutoff Saw Safety

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure the stock is tightly clamped in place before starting your cut. If it isn't, the blade will grab it and roll it around.
4. Keep your hands clear of the path of the blade at all times. Some of these saws cut automatically; on others, you control the cut. In either case, keep your hands clear and out of danger.
5. Do not force the cut. There is often a temptation to speed things up by pushing on the saw but this could overload the machine or damage the blade.
6. Although these saws cut automatically, you should always watch the cut as it proceeds. The blade could twist or jam, the stock could twist free, or the saw could fail to stop when it should. Be there.
7. Take care in handling fresh cut pieces of metal; they could be sharp and hot. Cool and deburr them right away.
8. If metal chips or filings build up in the saw, turn it off and clean it with a brush. Never use your hand. Metal slivers really hurt.
9. Wear eye and hearing protection.
10. Wear appropriate gloves when handling the stock.

General Safety Instructions for Operating Power Woodworking Machines and Tools

Check to insure that:

1. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
2. Goggles, glasses, or face shields are worn at all power machines.
3. Long hair is controlled by hairnet or appropriate cap.
4. The tool rest of the grinder is set properly.
5. Tool rests on lathes which are in operation are secured.
6. Tools and scraps are not left on the floor.
7. Oily rags are placed in a metal safety can.
8. Oil spots are wiped from the floor.
9. No tools with mushroomed heads or loose or broken handles are used.
10. All files have handles before students use them.
11. All accidents are reported to the supervisor and taken care of properly.
12. No “horseplay” of any kind occurs in the shop.
13. The tool room has no defective tools in the rack.
14. No safety guards are removed from machinery.
15. No operator walks away from his/her machine and leaves it running.
16. All danger zones are marked.
17. No one talks to or touches anyone operating a machine.
18. Shirt tails are to be tucked in at ALL times.
19. Coats or sweaters are not worn while students are working.

Operating a Table Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety goggles or glasses.
4. Make sure saw guards are in place and operative. Guards must be kept down over the saw while machine is being operated.
5. The saw must not be raised above the table *more* than absolutely necessary to make the cut, approximately 1/8 inch.
6. A push stick must be used when ripping narrow pieces of lumber.
7. The clearance block must be fastened to fence when cutting off short pieces of stock.
8. Fence must not be adjusted until saw is at a dead stop.
9. Sawdust underfoot is slippery; keep floor around saw area clean.
10. Use brush to keep table clear of scraps; never use the hands.
11. Fingers must be kept clear of track of saw, and hands must never be allowed to cross saw line in advance of the end of the board while machine is in operation.
12. Reaching over the saw blade or passing wood over saw blade is prohibited.
13. All special set-ups and dado heads must be inspected by supervisor before power is turned on.
14. The dado head must be taken off the saw arbor after use.
15. When helping to "tail-off" the saw, students must never pull on a board being ripped. They should hold board up and allow operator to push stock through saw.
16. Re-sawing must not be done on circular saw without special permission of the supervisor.
17. Cylindrical stock must not be cut on circular saw.
18. Never lower pieces of stock down over the saw. This operation is sometimes performed when cutting holes in rails for drawer fronts. Special permission should be obtained from the supervisor for doing this type of work.
19. Ripping stock without using the ripping fence or cross-cutting stock without using the sliding cross-cutting fence is extremely dangerous and is absolutely forbidden. This rule applies to dado head work.
20. See that no fence or set-up will be in line of saw before starting work or turning on power.
21. Be sure that saw or tilting arbor saw will clear on both sides when sawing angles before power is turned on.
22. Never stand directly behind the blade; stay to the left.
23. Only operator turns machine on and off.
24. Only operator should be in safety area of the saw.

Operating a Band Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety goggles or glasses.
4. Always keep guards in place. Both upper and lower wheels, as well as most of the blade itself, shall be guarded.
5. Adjust the guard to about 1/4 inch above thickness of stock.
6. The upper and lower guides shall be properly adjusted when machine is stopped completely, so that there will be a minimum of blade breakage.
7. A clicking or cracked blade should be stopped immediately.
8. The saw shall be allowed to stop itself naturally in order that the blade may not be damaged.
9. Plan your cuts carefully; layout and make release cuts before cutting long curves.
10. If the stock binds or pinches the blade, do not attempt to back out until power has been shut off and the machine stops.
11. Proper blade width for the diameter of work being cut shall be used. Avoid cutting a radius to small for the blade width and pinching the blade.

Blade Width	1/8"	3/16"	1/4"	3/8"	1/2"	3/4"	1"
Cut Radius	3/16"	5/16"	5/8"	1 1/2"	2 1/2"	5 1/2"	7"

12. The right side of the machine is generally the most dangerous place to stand in case of blade breakage.
13. Proper blade tension shall be maintained.
14. The blade shall be sharp and properly set at all times.
15. Remove scrap material from saw table with a stick or brush.
16. If the blade breaks, shut off power and stand clear until machine stops entirely.
17. Make cuts always under power--never while machine is coasting.
18. Leave the machine only after power is turned off and blade has stopped moving. This is especially important with the band saw.

Operating a Jig/Scroll Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear face shield, safety glasses, or goggles.
4. Cut only stock with a flat surface on bottom.
5. Make adjustments only when machine is at a dead stop.
6. Install saw blades to cut on the downstroke.
7. Tighten blade securely in lower vise, then in upper vise. Check blade for correct tension.
8. Make sure the saw blade is the proper size for the job.
9. Adjust hold-down so it will be as close as possible to the work.
10. Turn machine by hand to make sure all parts are clear.
11. Make sure that no one but you is inside the operator's line.
12. Select correct machine speed for the material and blade type.
13. Lower the hold-down foot to press lightly on the surface of the wood.
14. Turn on power after permission is given.
15. Hold material firmly.
16. Feed the material into the machine at a moderate rate of speed.
17. Keep fingers away from saw and hands out of the path of saw.
18. Report mechanical defects or a broken blade to the supervisor.
19. Turn off power after using scroll saw and stand by until the machine has stopped.
20. Clear away scraps of wood on the table only after saw stops running.

Operating a Radial Arm Saw

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear safety goggles or glasses.
4. Always keep guards in place.
5. Before starting the machine, all clamping devices should be tight.
6. Saw must be kept well sharpened.
7. Be sure saw swings clear and free.
8. Place stock snugly against backstop, and flat on the table.
9. Operate the saw with your left hand, never reach across your body to operate the saw.
10. Set the anti-kickback device 1/8 inch above the material to be cut.
11. While ripping, the rip lock should be tight.
12. Two people are necessary while ripping.
13. While ripping, be sure to feed the material from the infeed end of the saw guard, never from the kickback end. Make no exception to this rule.
14. Before making special adjustment, the saw must be fully stopped.
15. Before starting the motor, make sure everything is clear of the cutter.
16. Remove scraps from the path of the radial-saw blade with a piece of wood while the saw is at a dead stop.
17. Stand to one side and keep your hands away from the direction of travel of the radial-saw blade.
18. A radial arm saw is used primarily for crosscutting stock. Use a table saw for ripping when possible.

Operating a Planer/Surfacer

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
89. Wear safety glasses or goggles.
90. Make sure guards are in place and operative.
91. Do not plane two or more pieces of stock with various thicknesses. It could be kicked out. Plane only one thickness at a time. (Note: Some planers have sectional feed rollers, which could allow planing various thicknesses. Supervisors make appropriate decision.)
92. Keep your fingers from under the stock as it is fed through the planer.
93. Stock must be at least 15 inches long or greater than the distance between centers of infeed and outfeed rollers. True one face of the stock on the jointer before planing.
94. Always make sure machine is turned off before leaving.
95. Make sure no one is behind machine while in operation.
96. Always stand erect and to one side of work being planed.
97. Do not look into the planer as board passes through.
98. Plane no thickness less than 3/8 inch.
99. Stock that is 8 inches in width or less should not be planed more than 1/16" per cut.
100. Stop the planer and run all pieces through, reducing all to the same thickness.
101. With a rule, measure the thickness of the stock at the thickest point.
102. Place the stock on the bed of the planer with the working face down and the grain turned so that the knives will cut with the grain. Hold the board flat on the feed-in table when starting the cut. The knives on a single-surface planer cut on the upper side and revolve in a direction opposite to the direction of feed.
103. Never attempt to plane cross-grain.

Operating a Jointer

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
104. Wear safety glasses or goggles.
105. Make sure guard is in place and operating freely.
106. Always check the depth of cut before starting the machine.
107. Plane no thickness greater than 1/4 inch.
108. Keep your fingers well away from the cutterhead and never placed on the stock above the cutterhead.
109. Stock must be at least 18 inches long.
110. Always use a push stick to push the end of the stock across the cutterhead.
111. Always make sure machine is turned off before leaving.
112. Make sure everyone is from behind machine while in operation.
113. Always stand erect and to one side of work being planed.
114. Never attempt to plane cross-grain.

Operating a Power Miter Saw

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Wear face shield, goggles, or safety glasses.
4. Make sure all guards are in place and are operating properly.
5. Be sure power is disconnected before making angle adjustments or changing blades.
6. Always hold the work firmly against the fence and table.
7. Never reach across your body to operate the saw.
8. Allow motor to reach full speed before starting to cut.
9. Apply smooth steady pressure to the motor when cutting.
10. Lock the slide (if equipped) when not in use. When using the slide, start your cut at the front of the work and push the saw into the work.
11. Use the brake to stop the blade before removing scrap or chips from the work area.

Operating a Portable Jig Saw

1. Operate only after you have received instruction.
2. Wear proper clothing while operating machine. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Always use proper eye protection.
4. Make sure all guards are in place and are operating correctly,
5. Make sure the blade is the correct type for the material and that it is tightly clamped in the chuck.
6. Be sure the switch is off before connecting to the power source.
7. Use vise or clamps to securely hold material to be cut.
8. Keep cutting pressure constant; do not force the blade into the work.
9. Always keep the base tightly against the materials being cut.
10. Do not set the saw down on the bench until it has stopped.
11. If the blade is in the tool, be sure and lay the tool on its side.

Operating a Portable Circular Saw

1. Operate only after you have received instruction.
2. Wear proper clothing. Remove jewelry, eliminate loose clothing, and confine long hair.
3. Make sure all guards are in place and operating properly.
4. Wear face shield, goggles, or safety glasses.
5. Make sure the telescoping guard returns automatically to cover the blade after each cut.
6. Check the base setting for the proper depth of cut.
7. Make sure the power cord is clear of the blade.
8. Be sure the material you are cutting is adequately supported.
9. Do not start the cut until the blade has reached full speed.
10. Advance the saw slowly, straight through the work. Do not twist or turn.
11. If the saw blade binds or smokes, stop cutting immediately.
12. The blade should be extended below the work until the blade gullets clear the material.
13. Do not set the saw down until the blade stops.

Using a Woodworker's Vise

115. Keep the vise tight on the bench. A loose vise is inefficient.
116. Keep your work clean. Never oil or grease a woodworker's vise.
117. Do not over-tighten.
118. Normal handle leverage holds jaws securely. Do not hammer the handle. Never pound to tighten or loosen. Do not use handle extension.
119. Avoid using woodworker's vise to clamp glue joints. Dried glue on vise screw, etc., makes vise operation difficult.
120. Do not use the vice to hold metal objects.

Gas Powered Concrete Mixer Safety

1. Transport and handle fuel only when contained in approved safety container.
2. Do not smoke when refueling or during any other fuel handling operation.
3. Do not refuel while the engine is running or while it is still hot.
4. If fuel is spilled during refueling, wipe it off of the engine immediately and discard the rag in a safe place.
5. Do not operate the equipment if fuel or oil leaks exist—repair immediately.
6. Never operate this equipment in an explosive atmosphere.
7. Avoid contact with hot exhaust systems and engines.
8. Allow all components in the engine compartment to cool before performing any service work.
9. Never leave mixer unattended while running.
10. Mix only concrete.
11. Never perform any work on the mixer while it is running.
12. Before working on the mixer, stop the engine and disconnect the spark plug wire(s) to prevent accidental starting. On electric models, disconnect the electric cord at the mixer.
13. Keep cowl closed and latched during the operation, close and latch cowl immediately after starting.
14. Keep hands, clothing and jewelry away from all moving parts.
15. Keep all guards in place, including drum guards.
16. Never place your hands or any solid object into the drum while the mixer is in operation.
17. Starting fluid (ether) is highly flammable, do not use or an explosion or fire may result.
18. Never operate unit in a poorly ventilated or enclosed area.
19. Avoid prolonged breathing of exhaust gases.
20. Engine exhaust fumes can cause sickness or death.

WEAR PROTECTIVE CLOTHING

1. Wear close fitting clothing and safety equipment appropriate to the job.
2. Prolonged exposure to loud noise can cause impairment or loss of hearing.
3. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.
4. Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

PREPARE FOR EMERGENCIES

1. Be prepared if a fire starts.
2. Keep a first aid kit and fire extinguisher handy.
3. Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

Eye Protection

1. Always wear splash goggles when operating mixer.

Towing

1. Warning: Do not tow the mixer with the drum in the dump position. Mixer may become

- unstable and tip over when hitting a curb, pothole, or other obstruction.
2. Warning: Always properly attach safety chains before mixer is towed. Maximum towing speed 55 MPH (90 km/hr). Reduce speed according to highway conditions.
 3. Use safety chains and hitch pins with a safety pin.

Practice Safe Maintenance

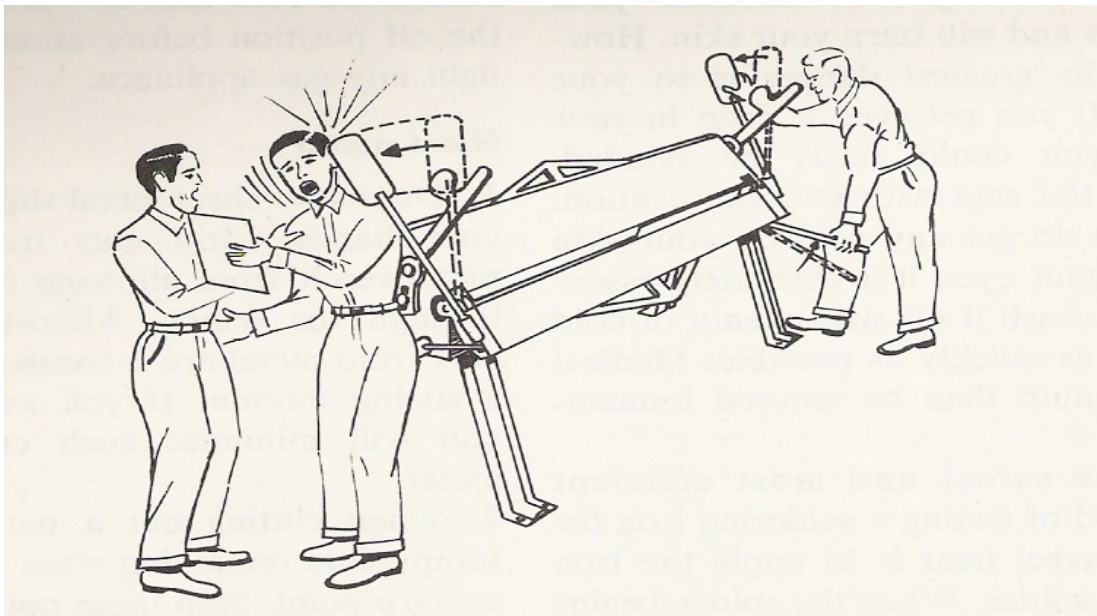
1. Understand service procedure before doing work. Keep area clean and dry.
2. Never lubricate, service, or adjust machine while it is moving. Keep hands, feet, and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.
3. Securely support any machine elements that must be raised for service work.
4. Keep all parts in good condition and properly installed. Repair damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.
5. Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

Cornice Brake

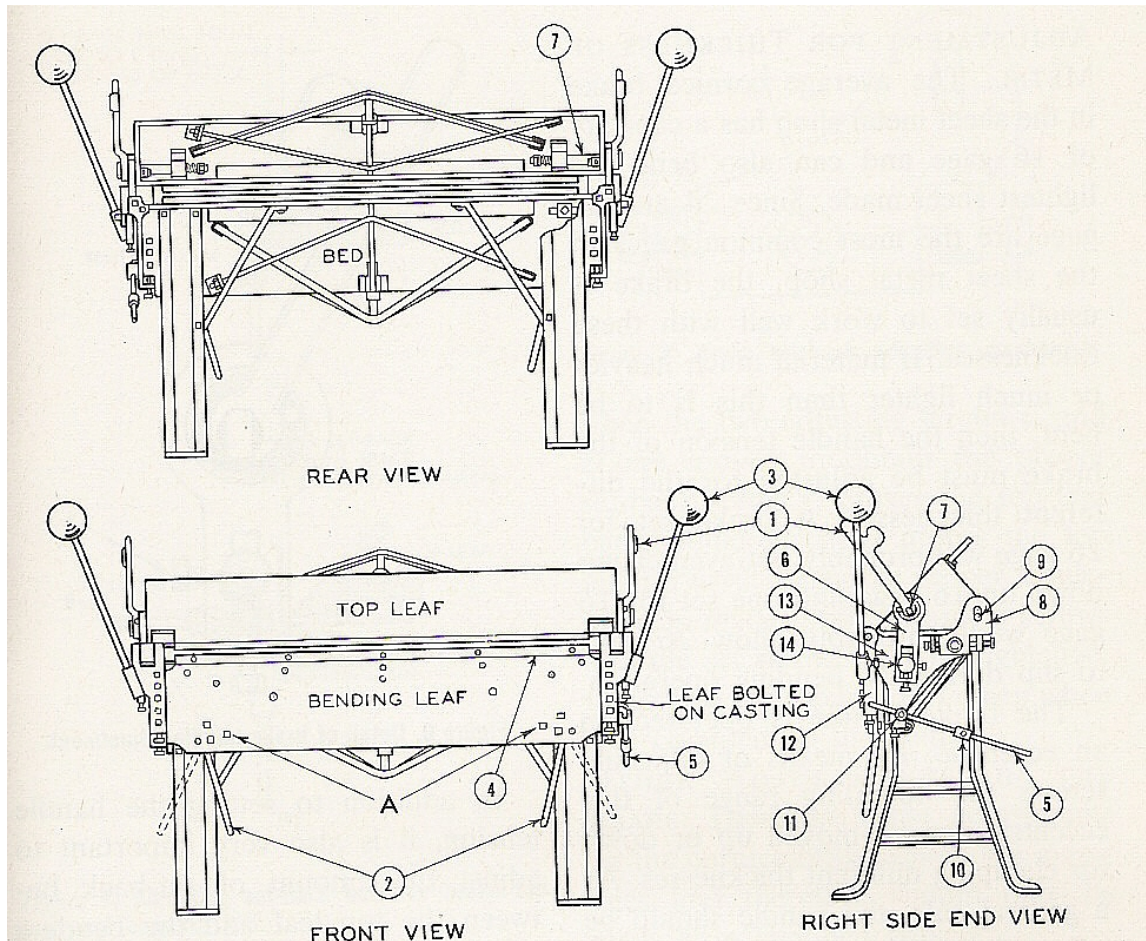
There are many types of brakes available to use when working with sheet metal. The cornice brake is the most commonly used. Safety is very important when it is time to use the brake.

Key Safety Practices

1. Do not place your hand in the cornice brake when someone else is operating the handle.
2. Make sure when going to use the brake that no one else is near the counterbalance balls to be hit by them.
3. If you are standing in front of the brake, stand back so that you will not be struck by the handles that project from the leaf when it is swung up.
4. Never bend rod or wire on any sheet metal brake. This will damage the blade and the bending leaf.
5. Never pound on a brake with any type of steel hammer. Always use a wooden mallet.



Before using the brake, the operator should be able to identify and know where and what each part is on the brake. A diagram of the brake is provided on the following page; the name is listed following the diagram.



The 3 major parts of the brake are the bed, top leaf and bending leaf (shown in the front and rear views).

Additional parts to the brake are numbered within the 3 diagrams, labeled with a number.

1. Clamping handle on each side for holding the sheet in position.
2. Two positions handle on each side, for operating bending leaf.
3. Balance weights, adjustable to make bending operations easier.
4. Upper bending leaf bar, removable when bending small locks.
5. Adjustable stop gage, used to form any desired angle.
6. Clamping link which operates the top shaft.
7. Top shaft.
8. Slot casting for adjusting the bending bar for various gages of metal.
9. Slot casting pin.
10. Adjusting stop slide on the stop gage for bending locks at various angles
11. Stop gage casting.
12. Bending leaf casting.
13. Bed end casting.
14. Link adjusting block.

Combustibles and Toxic Substances Safety⁹

Topic	Information
Combustibles and Toxic Substances	Many industrial supplies are flammable, explosive or subject to spontaneous combustion. Store combustible supplies and waste in fire safe containers.
Chemicals/Hazardous Substances	Follow procedures for safe handling, use, storage, and disposal of chemicals/hazardous substances, including emergency procedures and spill clean up. Label containers if you transfer the product from the original container. Know where to find Material Safety Data Sheets (MSDS) and be able to answer the following questions for each product used: <ul style="list-style-type: none"> <input type="checkbox"/> What are the hazards of the product you are using? <input type="checkbox"/> How do you protect yourself from the hazards of the product? <input type="checkbox"/> What would you do if an emergency occurred? <input type="checkbox"/> Where can you find out more information about the product you are using?
Corrosives	Acids and caustics can burn skin and eyes causing permanent damage; they can also corrode metal so wear goggles, gloves, and protective clothing.
Flammables and Combustibles	Many industrial supplies are flammable, explosive or subject to spontaneous combustion, so store combustible supplies and waste in fire safe, closed containers, and keep them away from ignition sources.
Hazardous Waste	Follow procedures for handling and disposing of hazardous waste. Many counties provide for disposal of hazardous waste.
Poisons	Follow procedures for the safe use of poisons and label the containers if you transfer the product from the original container.
Substances Under Pressure (e.g. compressed gas cylinders)	Cylinders can explode if dropped or heated, so keep them away from ignition sources. Always follow procedures for safe use.
Wood Dust	Note that some wood dusts cause allergies (e.g., oak, mahogany, Western red cedar, redwood).

⁹ Adapted from Heads Up for Safety

Plumbing Safety

Materials

The materials used in plumbing may expose the plumber to health hazards.

- Glues and solvents used with plastic pipe are of special concern. Use in well ventilated areas and avoid ignition sources. See MSDS for more information.
- Pipe sealing compounds may also poses some hazards (see MSDS).

Sanitation

Special precautions should be taken with working on existing sewer pipe. Sewers contain biological health hazards and possibly toxic chemicals. Personal protection equipment should be used and skin thoroughly washed after exposure.

Personal Safety Equipment

Safety glasses should always be worn to protect the eyes from flying debris, chemicals, and biological hazards. Gloves, boots, and coveralls may also be appropriate under some conditions.

General Safety Tips

- Electrical tools should be used with extreme caution in wet areas. Follow safety instructions for the tool.
- Always check for existing wiring and other pipes before boring holes for new pipes.
- Torches used for soldering are hot and freshly soldered joints are also hot posing a burn hazard.
- Care must be taken when soldering pipe in place not to burn the surrounding building. Have fire extinguishers on hand and always check charred surfaces for heat.
- Spent fuel bottles should be disposed of properly.
- Lead solder is not to be used for potable water plumbing.
- Threading machines create sharp shavings, heat, and hot pipe. Use threading machines according to the manufacturer's directions.

Painting Safety Rules

Preparation

1. Wear dust masks when sanding.
2. Wear eye protection at all times.
3. Never sand materials containing lead (old paint).
4. Use dust collection systems when possible.
5. Never grind in an area where painting is in progress (spark hazard).

When using stains, paints, and other finishes:

1. Wear approved eye protection.
2. Wear a respirator when spraying finishing materials.
3. Avoid breathing fumes from toxic materials.
4. Wear rubber or vinyl gloves to minimize risk of skin irritations when using a cloth or a pad to apply solvents, bleaches, stains, and finishes and when cleaning brushes.
5. Wash your hands after using any finishing materials.

Finishing Room Safety

1. Do all finishing in a separate, well-ventilated area specifically designed for finishing.
2. Make sure the proper types of fire extinguishers are available in the room.
3. For spraying, use a properly installed spray booth. Keep the spray booth clean and well maintained.
4. Keep the entire area clean and free from spills.
5. Never leave opened finishing materials unattended.
6. Never use tools or machines that can cause sparks or start a fire in the finishing area.

Using and Storing Paint and Solvents

1. Solvents emit dangerous fumes. Use only in a well-ventilated area.
2. Many solvents are extremely flammable. Keep all solvents away from sources of heat, sparks, and fires.
3. Store paint and solvents in their original containers. If, for some reason, this is not possible, be sure the new container is clearly labeled.
4. Be sure to read and obey the labels on each type of solvent (refer to MSDS for complete list of hazards and precautions).

Health and Safety Guidelines for Painting¹⁰

In industry, the most popular method of applying paint is to spray it on, using compressed air, a high velocity airless sprayer or an electrostatic applicator. Paint can also be applied with brushes. The material itself is the primary hazard when painting. Painting may expose you to potentially dangerous chemicals which may damage your health. This guide outlines some of the hazards associated with painting and provides information on how to work safely while painting.

Choose paint materials with safety in mind. Never use materials which are unlabeled or their contents cannot be determined. Always follow the safety recommendations for the material being used.

Health Hazards

Overexposure to a substance means too much has been breathed in, swallowed or absorbed through the skin. The possible effects of overexposure to paint and the chemicals it contains vary according to the type of paint. Some health problems caused by overexposure to paint material are:

- drowsiness;
- dizziness/light headedness;
- disorientation;
- nausea/vomiting;
- eye and throat irritation;
- dermatitis;
- general allergic response such as hives;
- asthma-like wheezing with tightness in the chest;
- heavy metal poisoning (lead, chromium, nickel and cadmium); or
- nerve, kidney or liver damage.

A wide variety of ingredients are used in paints and thinners. These chemicals are not found in all paints, but you have probably come into contact with some of them at one time or another. The following is a list of common ingredients of paints and thinners:

Pigments

- white lead
- red/brown iron oxide
- chromium oxide
- iron blue
- cadmium yellow
- lead powder

¹⁰ Adapted from Government of Alberta, Human Resources and Employment (<http://www3.gov.ab.ca/hre/whs/publications/pdf/ch004.pdf>) and State Farm Insurance Fund safety materials found at: <http://www.scif.com/safety/safetymeeting/SafetyMtgTopics.asp>

Solvents – thinners

- toluene
- xylene
- carbon tetrachloride
- perchloroethylene
- isopropyl alcohol
- cyclohexanol
- n-amyl acetate
- methyl ethyl ketone
- cyclohexanone
- methylene chloride

Resins

- isocyanates (contained in urethane resins)
- epichlorohydrin (contained in epoxy resins)

You may already be familiar with the paints you use regularly, but do you know their possible harmful effects? Ask for the Materials Safety Data Sheet (MSDS) (see below) for each paint. These are available from the manufacturer or paint supplier. The MSDS will describe the possible hazards and what precautions are needed. All of the above listed ingredients have standards for worker exposure.

Spray Painting Safety

Spray painting is a common and effective way to protect and beautify parts, products, vehicles, and buildings. Spray painting allows coverage of large areas with even coats of primer, paint, sealers, and other coatings. However, workers in spray painting operations need to recognize and guard against the hazard associated with spray painting processes. Hazardous chemicals in coatings and solvents can enter the body several ways. Workers can inhale chemical vapors from spraying, absorb the chemical by skin contact or inject the chemical with high pressure spray painting equipment.

As proper ventilation is important when working with paint coatings, a spray booth is an excellent way to remove spray paint vapors and debris from a worker's breathing zone. Many coatings contain flammable substances that are aerosolized when sprayed through powered equipment and without proper ventilation, such as in a spray booth, these vapors can build up and create an explosion and fire danger. But to provide maximum protection, the spray booth must be properly maintained, including regular cleaning of filters and overspray. And to prevent sparking a flammable substance, smoking and other sources of flame near spray painting operations should be prohibited and tools should be properly rated and grounded for work in a spray painting area.

Because much of the equipment used for spray painting and surface preparation uses compressed air, workers should be aware that noise can be a risk, so should wear hearing protection when working with air powered tools.

How to Control Health Hazards

Following a few sensible rules can help to reduce exposure to chemical hazards.

Environmental Control

Whenever possible, painting or priming operations should be done in a spray booth or room. These areas have been designed to reduce exposure to paint vapors and additives – use them correctly. You should make sure that the ventilation in the spray booth or room is adequately maintained and working properly.

Before using the spray booth or room:

- turn on the ventilation system,
- check the spray booth filters and change if necessary, and
- turn on the make-up air unit.

When painting in an enclosed space (a room):

- provide outside ventilation air with fans or open windows,
- turn off ignition sources like wall heaters.

When painting:

- follow the equipment manufacturer's instructions,
- avoid using plastic drop cloths on the floor (slip hazard),
- never point a spray gun at yourself or anyone else,
- position yourself so the piece you are spraying is between you and the exhaust fan,
- do not over spray, and
- use appropriate personal protection.

Personal Protection

One positive step you can take to ensure continuing good health is to use personal protective equipment. Here is a brief description of some of the protective equipment available.

Respirators

Two types of respirators, the air-purifying and the atmosphere supplying, are commonly used in spray painting. **IMPORTANT** – you **MUST** use the correct type of respirator for the job being done and the chemicals being used.

The air-purifying type of respirator should be used only during exposure to those specific chemicals, or groups of chemicals, described on the respirator cartridge. These cartridges are good only for a limited time and must be replaced with new ones when:

- you can smell vapors in the mask,
- they become difficult to breathe through, or
- they have been used for their specific lifetime.

The atmosphere-supplying type of respirator must be used in some paint spraying operations, particularly with urethane paints or when painting in a confined space e.g. inside a tank.

REMEMBER — whichever respirator is used, it must **FIT** properly to ensure adequate protection (check the manufacturer's instructions). Respirator maintenance and cleaning is important. No one wants to use a dirty, leaky respirator which has been worn previously by someone else. Keep your respirator in good condition by cleaning and sanitizing it regularly. Store it in a clean place. Check it for pliability and signs of deterioration before you wear it. If the respirator needs repair, use only the manufacturer's recommended replacement parts.

With a little thought, and a small amount of effort, your respirator will protect you for a long time.

Eye and Hearing Protection

Without good eyesight you cannot do your job properly — so why risk eye damage, or loss of eyesight from solvent spray or splashing? Wear your SAFETY GOGGLES to protect your eyes from paint materials as well as the particulates created during sanding and grinding.

Some painting equipment such as grinders and compressors create loud noise. Hearing protection is required when noise levels exceed 85 db.

Protective Clothing

Some of the chemicals you work with can injure skin or cause dermatitis. Coveralls and gloves prevent these chemicals from coming into contact with your skin, reducing the risk of damage. Wear your coveralls and gloves whenever working with chemicals. Clean your gloves and wash your coveralls regularly to prevent chemicals from accumulating, especially around the cuffs where they can easily come into contact with your skin. As an additional protective measure, use BARRIER CREAMS on your hands, face and neck. Check to make sure you have the correct barrier cream for the chemicals being used.

Fire and Explosion Hazards

Because of the danger of fire and explosion where paints which contain flammable solvents are being used, care should be taken to remove all potential sources of ignition before starting work. This means naked flames, cutting and welding torches, gas fired heaters and materials which may give off sparks, whether electrical, mechanical, friction or static, and there must be no smoking. Make sure the correct types of fire extinguishers are available at the work site.

REMEMBER different types of fires require different types of extinguishers.

IMPORTANT: Flammable materials are required to be stored in flammable materials storage cabinets. Many paint and solvents are flammable materials.

Dust and Preparation

Many painting projects require preparation of the materials to be painted. Preparation often involves sanding of the surface which creates a health hazard if dust masks are not worn. Ideally dust collection systems should be used to prevent large amounts of small particulates from entering the air.

Sanding and scraping of old paint may hold additional hazards if the old paint contains lead.

Things to do and not to do before painting

- **DO** Post “No Smoking” and “No Welding” signs.
- **DO** Remove portable lamps and heaters from the area.
- **DO** Make sure painting is done away from naked flames, sparks, non-explosion proof motors or any other source of ignition.
- **DO** Check the ventilation system to make sure it is on and working correctly.
- **DO** Electrically ground all spraying equipment.

- **DO** Make sure approved respirator, eye goggles and any other protective equipment required for the job are worn.
- **DON'T** Smoke.
- **DON'T** Take more paint out of the store room than you can use in one day.

Material Safety Data Sheet

What is a Material Safety Data Sheet (MSDS)?

A Material Safety Data Sheet is a document that contains information on the chemical make-up, use, storage, handling, emergency procedures and potential health effects related to a hazardous material. The MSDS contains much more information about the material than the label on the container. MSDS are prepared and written by the manufacturer of the material.

What is the purpose of an MSDS?

The purpose of an MSDS is to inform you of:

- The material's chemical make-up.
- The material's physical properties or fast acting health effects that make it dangerous to handle.
- The level of protective gear you need to wear to work safely with the material.
- The first aid treatment to be provided when someone is exposed to the material.
- The preplanning needed for safely handling spills, fires, and day-to-day operations.
- How to respond to accidents.

What information is on the MSDS?

There are 9 categories of information that must be present on an MSDS. These are:

- Chemical Identity
- Health Hazard Data
- Manufacturer information
- Precautions for Safe Handling and Use
- Hazardous ingredients
- Exposure controls/personal protection
- Physical and chemical properties
- Fire and Explosion Hazard Data

Reactivity Data

Even with all of the above information on an MSDS, it might not have everything you need to know about a material. For example, health hazard information is usually presented in general terms. Your health and safety specialist should be able to help you find more information if it is needed.

Why is an MSDS hard to read?

Originally, MSDSs were intended to be used by industrial hygienists, chemical engineers and safety professionals. Now, MSDSs are used by employers, employees, emergency responders and anyone else requiring information on a material. Some MSDSs look very different from

others. This is because law specifies the content of the MSDS, but the format is left up to the manufacturer of the material.

When would I use an MSDS?

You should always know the hazards of a material before you start using it. For most people who work with a material, there are sections of the MSDS that are more important than others. You should always read the name of the material, know the hazards, understand the safe handling and storage requirements, and understand what to do in an emergency.

Hazard Communication Standard

MSDSs form the cornerstone of this standard. The Hazard Communication standard requires employers to; maintain an inventory of hazardous materials, provide employees training on the potential hazards associated with a material, obtain and maintain MSDSs for each material onsite, establish proper methods and types of labels, and inform contractors of the hazards that their employees may be exposed to in their work area.

More MSDS Information

For more detailed information, discuss your questions with your safety and health representative, or visit the website maintained by the Occupational Safety & Health Administration at <http://www.osha.gov/SLTC/hazardcommunications/index.html>

Ladder Safety

- Ladders are commonly used for painting. Ladder safety begins with selecting the right ladder for the job and includes inspection, setup, proper climbing or standing, proper use, care, and storage. This combination of safe equipment and its safe use can eliminate most ladder accidents.
- Always check a ladder before using it. Inspect wood ladders for cracks or splits. Inspect metal and fiberglass ladders for bends and breaks. Never use a damaged ladder. Tag it "Defective" and report it to your supervisor/teacher.
- When setting up a ladder, make sure it's straight and sitting firmly on the ground or floor. If one foot sits lower, build up the surface with firm material, don't set it on boxes, bricks or other unstable bases. Lean the ladder against something solid, but not against a glass surface. Make sure the ladder is placed at a safe angle, with the base away from the wall or edge of the upper level about one foot for every four feet of vertical height. Keep ladders away from doorways or walkways, unless barriers can protect them.
- Keep the steps and rungs of the ladder free of grease, paint, mud or other slippery material. And remember to clean debris off your shoes before climbing. Always face the ladder when climbing up or down, using both hands to keep a good grip on the rails or rungs. Never carry heavy or bulky loads up a ladder. Climb up yourself first, and then pull up the material with a rope or bucket.
- Many ladder accidents occur because of slipping or skidding. You can prevent these accidents by equipping the ladder with non-slip safety feet, blocking its base or tying it to a sound, permanent structure.
- Overreaching is probably the most common cause of falls from ladders. A good rule is to always keep your belt buckle inside the rails of a ladder. Don't try to move a ladder while you're on it by rocking, jogging or pushing it away from the supporting wall.

- When you've finished the job, properly store the ladder so it won't be exposed to excessive heat or dampness and will be in good condition for the next time.

Solvents

Solvents are so common in many work places that workers forget how dangerous they are. A solvent can be generally described as a substance, usually a liquid, that is used to dissolve another substance. Although solvents can be used safely, health problems can result from skin contact with solvents or from inhalation of their vapors. In addition to the health hazards, many solvent vapors are flammable and explosive.

One of the most common health hazards associated with exposure to solvents is dermatitis. Contact dermatitis can develop from a single or from multiple exposures. It can leave the skin susceptible to a short-term infection or to a chronic condition. Exposure can also result in sensitization to the solvent, which is a delayed allergic reaction that often becomes more severe with subsequent exposures.

One big danger with solvents is that they can cause trouble before you realize what's happening. Depending on the type and concentration of the solvent, exposure effects can range from mild respiratory irritation to severe damage to body organs and systems. In extreme cases, overexposure to solvent vapors can cause respiratory failure and death. When working with solvents, it's important to know what solvents are being used and what steps should be taken to protect against harmful or dangerous exposures. To optimize safety follow these suggestions:

- Know what solvents you're working with.
- Read the labels and the material safety data sheets of the solvents. They list the hazards, health effects, and safe handling procedures.
- Make sure the workspace is properly ventilated.
- Use recommended gloves, eye and face protection, boots, other protective clothing, or barrier creams as required.
- If respiratory equipment is used, make sure it gives appropriate protection for the exposure.
- Take care when pouring solvents from one container to another, as fire or explosions can occur from static electricity buildup.
- Clean up solvent spills promptly.
- Never wash your hands with solvents.
- Prohibit welding, cutting, soldering, and other sources of ignition in areas where solvents are used.
- Store flammable solvents in well-ventilated areas constructed of fire-resistant materials.
- Ground and bond all tanks and equipment for storage.
- Install readily accessible fire extinguishers in storage and work areas.

As with other toxic substances in the workplace, the preferred methods of hazard control are substitution of a less toxic substance in an operation, local exhaust ventilation, and enclosure.